NANOVEA

PHARMACEUTICAL TABLETS

ROUGHNESS INSPECTION WITH AN OPTICAL PROFILER

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INTRODUCTION

Pharmaceutical tablets are the most popular medicinal dosage used today. Each tablet is made up by a combination of active substances (the chemicals that produce pharmacological effect) and inactive substances (disintegrant, binder, lubricant, diluent – usually in the form of powder). The active and inactive substances are then compressed or molded into a solid. Then, depending on the manufacturer specifications, the tablets are either coated or uncoated.

To be effective, tablet coatings need to follow the fine contours of embossed logos or characters on tablets, they need to be stable and sturdy enough to survive handling of the tablet, and they must not cause the tablets to stick to each other during the coating process. Current tablets typically have a polysaccharide and polymer-based coating which include substences like pigments and plasticizers. The two most common types of table coatings are film coatings and sugar coating. Compared to sugar coatings, film coatings are less bulky, more durable, and are less time-consuming to prepare and apply. However, film coatings have more difficulty hiding tablet appearance.

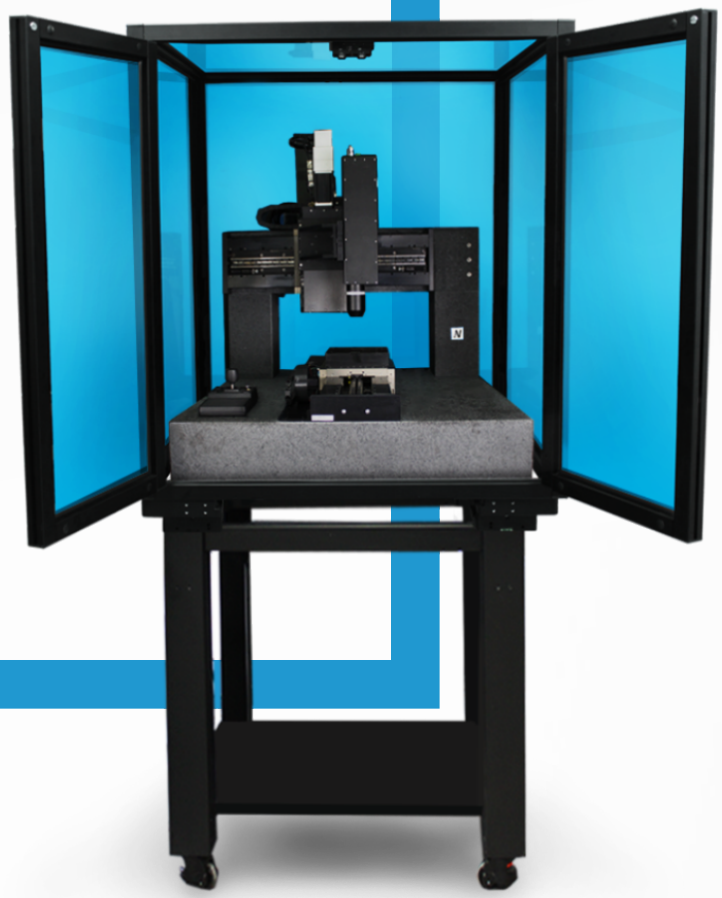
Tablet coatings are essential for moisture protection, masking the taste of the ingredients, and making the tablets easier to swallow. More importantly, the tablet coating controls the location and the rate in which the drug is released.

MEASUREMENT OBJECTIVE

*In this application, we use the **NANOVEA Profilometer** and advanced Mountains software to measure and quantify the topography of various name brand pressed pills (1 coated and 2 uncoated) to compare their surface roughness.*

It is assumed that Advil (coated) will have the lowest surface roughness due to the protective coating it has.

NANOVEA
HS2000



TEST CONDITIONS

Three batches of name brand pharmaceutical pressed tablets were scanned with the ***NANOVEA*** HS2000 using High-Speed Line Sensor to measure various surface roughness parameters according to ISO 25178.

SCAN AREA	LATERAL SCAN RESOLUTION	SCAN TIME
2 x 2 mm	5 x 5 µm	4 sec

THE SAMPLES

ADVIL

TYLENOL

EXCEDRIN

RESULTS & DISCUSSION

After scanning the tablets, a surface roughness study was conducted with the advanced Mountains analysis software to calculate the surface average, root-mean-square and maximum height of each tablet.

ISO 25178 SURFACE HEIGHT PARAMETERS

ADVIL		Tablet 1	Tablet 2	Tablet 3	Tablet 4	Tablet 5	Average	Standard Deviation
Sq (µm)	*Root-mean-square height*	1.220	1.406	1.045	1.766	0.9885	**1.285**	**0.315**
Sz (µm)	*Maximum height*	9.964	12.17	9.866	37.82	13.73	**16.71**	**11.91**
Sq (µm)	*Arithmetic mean height*	0.9706	1.117	0.8302	1.109	0.7652	**0.958**	**0.159**

TYLENOL		Tablet 1	Tablet 2	Tablet 3	Tablet 4	Tablet 5	Average	Standard Deviation
Sq (µm)	*Root-mean-square height*	6.813	6.224	5.541	5.785	3.049	**5.482**	**1.444**
Sz (µm)	*Maximum height*	70.72	53.62	50.24	47.43	30.79	**50.56**	**14.29**
Sq (µm)	*Arithmetic mean height*	5.130	4.768	3.917	4.404	2.407	**4.125**	**1.060**

EXCEDRIN		Tablet 1	Tablet 2	Tablet 3	Tablet 4	Tablet 5	Average	Standard Deviation
Sq (µm)	*Root-mean-square height*	4.119	4.542	3.489	3.462	2.851	**3.693**	**0.653**
Sz (µm)	*Maximum height*	62.10	57.48	41.20	40.10	31.49	**46.47**	**12.828**
Sq (µm)	*Arithmetic mean height*	3.032	3.173	2.726	2.677	2.132	**2.748**	**0.402**

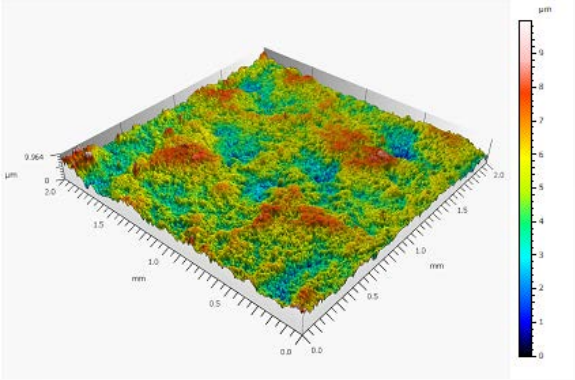
The calculated values support the assumption that Advil has a lower surface roughness due to the protective coating encasing its ingredients. Tylenol shows to have the highest surface roughness out of all three measured tablets.

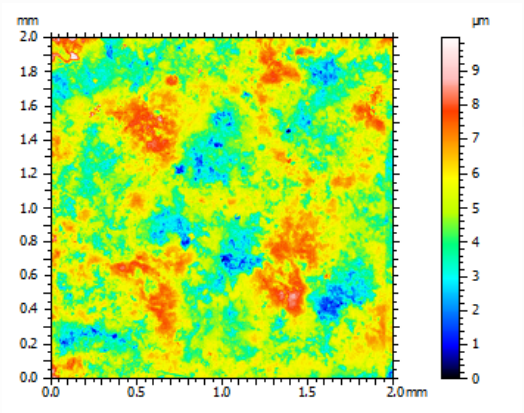
RESULTS & DISCUSSION

A 2D and 3D height map of each tablet's surface topography was produced which show the height distributions measured. One out of the five tablets were selected to represent the height maps for each brand. These height maps make a great tool for visual detection of outlying surface features such as pits or peaks.

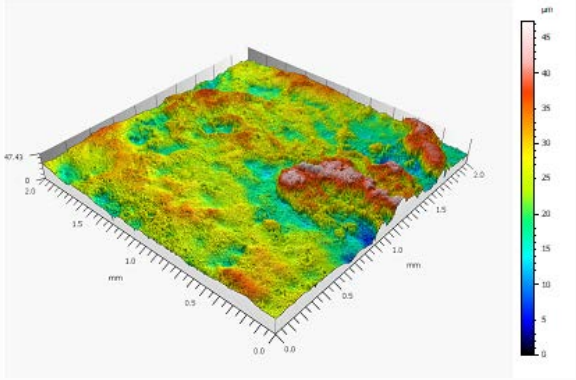
2D AND 3D FALSE COLOR VIEW OF THE SAMPLES

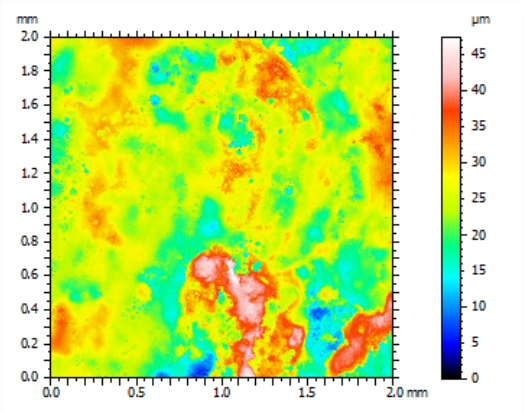
ADVIL



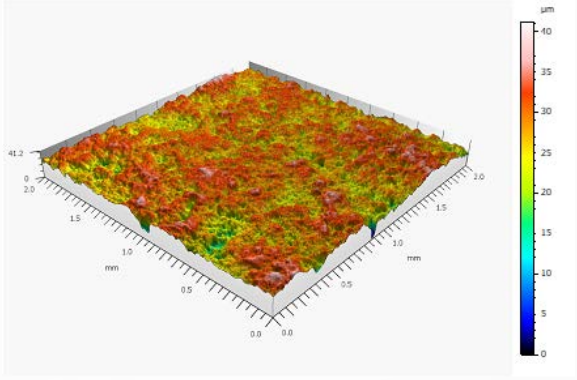


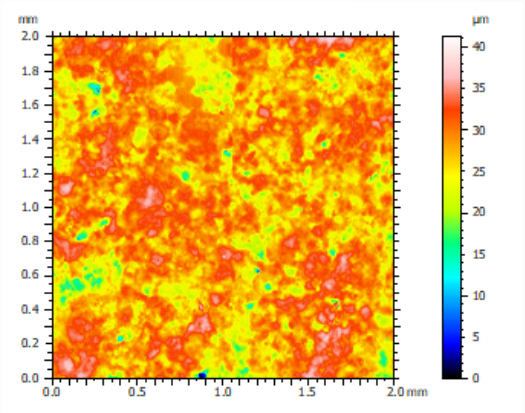
TYLENOL





EXCEDRIN





CONCLUSION

In this study, we analyzed and compared the surface roughness of three name brand pressed pharmaceutical pills: Advil, Tylenol, and Excedrin. Advil proved to have the lowest average surface roughness. This can be attributed to the presence of the orange coating incasing the drug. In contrast, both Excedrin and Tylenol lack coatings, however, their surface roughness is still differed from each other. Tylenol proved to have the highest average surface roughness out of all the tablets studied.

Using the ***NANOVEA*** HS2000 with High-Speed Line Sensor, we were able to measure 5 tablets in less than 1 minute. This can prove to be useful for quality control testing of hundreds of pills in a production today.